Zootaxa 2132: 53–64 (2009)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

New and less known Orthoptera (Insecta) from the island of Socotra (Yemen)

BRUNO MASSA
Department SENFIMIZO, University of Palermo, V.le Scienze 13, 90128 Palermo, Italy. E-mail: zoolappl@unipa.it

Abstract

A list of nine species of Orthoptera collected on Socotra is reported. Three of them were previously unrecorded on the island (*Trigonidium cicindeloides*, *Paratettix subpustulatus* and *Acrotylus insubricus*) and one (*Ochrilidia socotrae* **n.sp.**) was undescribed. Further systematic notes on *Glomeremus pileatus*, *G. mediopictus*, *Pyrgomorpha conica tereticornis*, *Acrotylus incarnatus* and *Sphingonotus insularis* are included. The East African *Acrotylus meruensis*, previously considered synonym of *A. incarnatus*, is proposed as a valid species, distinct from the latter.

Key words: *Ochrilidia socotrae* n. sp., systematic, distribution, new records

Introduction

Socotra is a very interesting island; originally part of the African-Arabian tectonic plate, since Tertiary it remained isolated. Its old isolation produced a very high degree of endemism both on plants and animals. Concerning Orthoptera, all authors agree with the very high number of endemic taxa, compared with the whole orthopterofauna. Socotran Orthoptera were previously recorded by Burr (1903), Krauss (1907), Uvarov and Popov (1957) and Popov (1984). I visited the island between 4th and 11st April 2008, with a group of botanists of the Botanical Garden of Palermo University. During the visit, I collected some specimens of Orthoptera; in addition, I received some others collected by P.Lo Cascio and F.Griti on February 2009. Some of them resulted new for the island, others are interesting for the reasons reported below.

If not differently indicated, material is preserved in the coll. B.Massa (University of Palermo).

Results

On the whole, I identified 35 species and here I report a short list of nine. Three of them were previously unrecorded on the island and one resulted undescribed; in addition, I improve the systematic status or the morphological description of other five.

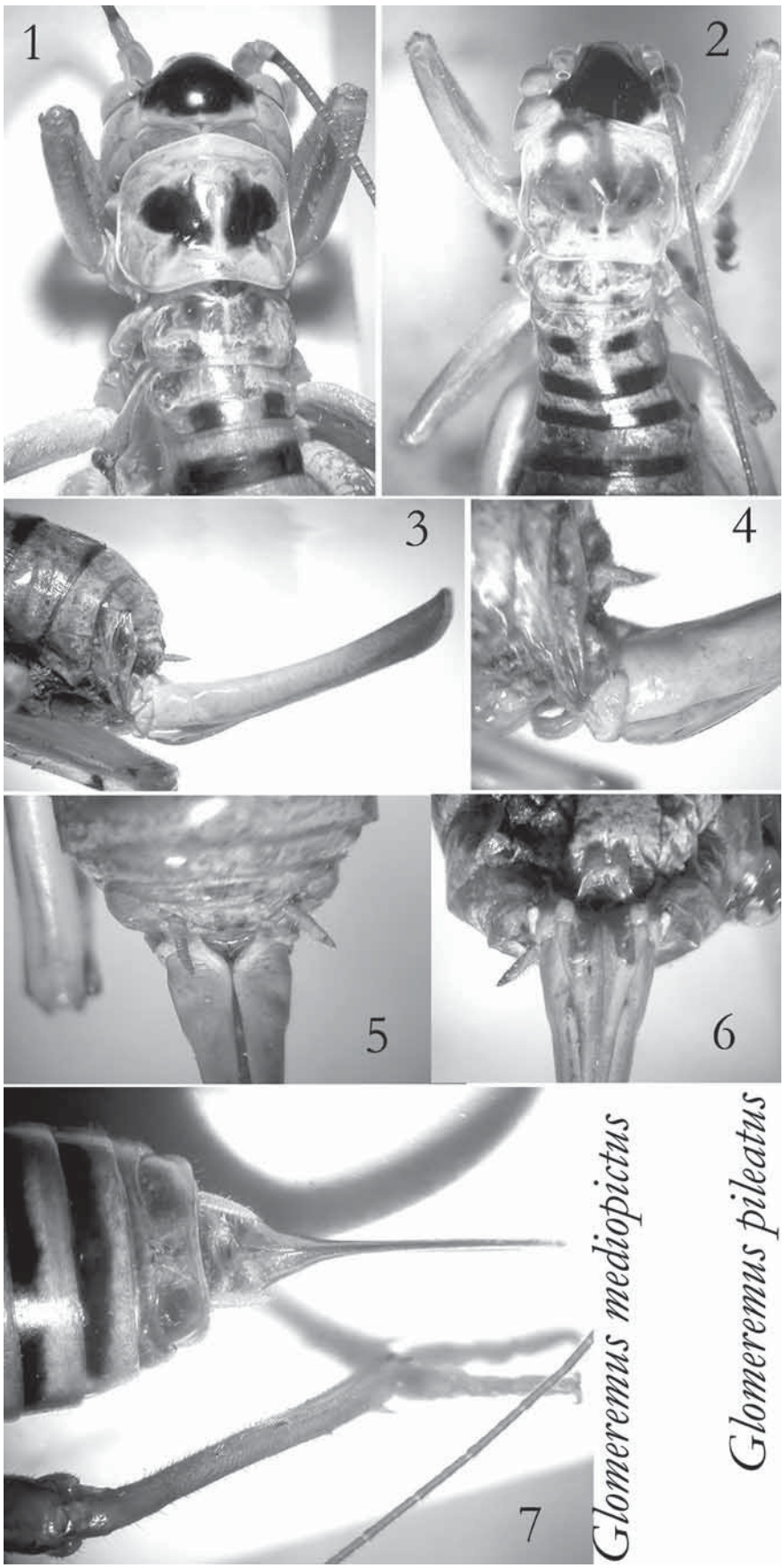
Fam. Gryllidae

Trigonidium cicindeloides Rambur, 1839

Material examined. Socotra, Zam Hom 7-8.IV.2008, B.Massa & A.Carapezza (2♂, 2♀).

Remarks. Previously unrecorded from Socotra, it is a a widespread species, covering Africa, Asia, Arabia and S Europe.

Accepted by D. Rentz: 22 May 2009; published: 15 Jun. 2009



FIGURES 1–7. *Glomeremus*. Figs 1–6: *G. pileatus*, two specimens from above (1, 2), ovipositor (3), subgenital plate (4), last tergites (5) and last sternites (6); 7: Ovipositor of *G. mediopictus*.

Fam. Gryllacrididae

***Glomeremus pileatus* (Krauss, 1902)**

Material examined. Socotra, Di Lisha 4.IV.2008, B.Massa on *Croton* sp. (1♂); Ra's Shoab 6.IV.2008, B.Massa (1♀); Wadi Zerig 8.IV.2008, B.Massa (1♂); Wadi Ayev 20.II.2009, P.Lo Cascio & F.Griti (1♀).

Remarks. The typical pattern of the pronotum with two dark bands in the middle of the pronotum (Figs. 1, 2) and microscopic stridulatory ridges, covered by setae, along the sides of the 2nd and 3rd terga consent to ascribe them to *G. pileatus*. Types (1 male and 2 females) came from Ra's Shoab (Krauss 1907), and according to Uvarov and Popov (1957) and Wranik (2003) it appears a rare species, known on the area of airport and Hadibou plain. The ovipositor is very thick, with an evident central furrow along its upper side (Figs. 3, 5); the subgenital plate is provided with an arc-like swelling (Figs. 4, 6). This species, lacking of scale-like tegmina, is possibly more related to *G. capitatus* Uvarov, 1957 than to *G. mediopictus* Uvarov, 1957. It shares with the latter the presence of stridulatory ridges, lacking in the former; conversely, the ovipositor of *G. mediopictus* (Fig. 7) and the general structure of the body are weaker than those of *G. pileatus*.

***Glomeremus mediopictus* Uvarov, 1957**

Material examined. Socotra, Wadi Ayev 10.IV.2008, B.Massa & A.Carapezza on *Croton* sp. (1♀; 1♂, 1♀ subad. nymphs).

Remarks. It is considered quite common (Wranik 2003). Antennae of this species are exceptionally long, up to three times of the body length. The ovipositor is much compressed along all its length (Fig. 7) and appears structurally much different from that of *G. pileatus*. Stridulatory ridges are much more evident than those of *G. pileatus*.

Fam. Tetrigidae

***Paratettix subpustulatus* (Walker, 1871)**

Material examined. Socotra, Wadi Zerig 8.IV.2008, B.Massa (4♂, 3♀, 1 nymph) (3♂, 2♀ in coll. H.Devriese).

Remarks. Krauss (1907) reported *Paratettix scaber* (Thunberg, 1815) from Socotra, but subsequently other authors did not identify Socotran specimens because of the difficulty in understanding the taxonomy of African *Paratettix* (see Uvarov & Popov 1957, who reported *Paratettix* sp. on Hadibou plain). Specimens here listed have been identified by Hendrik Devriese, who sent me the following considerations: "this is a very common species in Africa, but its status is not yet very clear. Indeed, this species, that was called *Paratettix scaber* by the late K.Günther in his revision of the African fauna, belongs to a complex of forms with a very high variability. In *Paratettix*, they are characterized by a frontal costa that is extending only slightly before the eyes and by unbanded tibia of the hind legs. There are at least three good species in the group: the real *Paratettix scaber*, which is restricted to the high grounds and mountains of Southern Africa, *Paratettix royi* (Günther, 1979), which occurs in Western Africa and *Paratettix subpustulatus*. Probably the Asiatic *Paratettix histricus* (Stål, 1861), sometimes placed in *Euparatettix*, belongs to the same group. The status of another taxon, *Paratettix cinereus* Bolivar, 1887 from Madagascar, is not clear. There are also animals with a short pronotum on the high mountanis of Eastern Africa (*Paratettix ruwenzoricus* Rehn, 1914) of which it is not yet known if they are a separate species or a brachypronotal form of *Paratettix subpustulatus*. After having studied several hundred specimens from numerous places, I have concluded provisionally that *Parattetix subpustulatus* is a very variable and widespread species. There are populations

with very small animals, like specimens from Socotra, and I have seen others from the Seychelles. Perhaps, the island populations have small specimens, but I have also seen small ones from some regions in Africa, and on Bioko, on the contrary, they are big. All this has to be analyzed by other methods (molecular or enzym analysis) before a definite conclusion can be drawn" (H. Devriese, pers. comm.).

Fam. Pyrgomorphidae

***Pyrgomorpha conica tereticornis* Brullé, 1840**

Material examined. Socotra, Hom Hil 5.IV.2008, B.Massa (4♀), 23-24.II.2009, P.Lo Cascio & F.Griti (2 nymphs); Qalansiyah river (Shata) 6.IV.2008, B.Massa (2♀, 1 nymph); Qalansiyah Mt. 6.IV.2008, B.Massa (1♂, 2♀); Ra's Shoab 6.IV.2008, B.Massa (1♂, 1♀); Zam Hom 8.IV.2008, B.Massa (2♀); Di Hamri Beach 9.IV.2008, B.Massa (1♂, 1♀); Wadi Ayev 10.IV.2008, B.Massa (2♀); Wadi Da'arho 21.II.2009, P.Lo Cascio & F.Griti (1♀); Dacsa Is. 27.II.2009, P.Lo Cascio & F.Griti (2♀).

Remarks. Uvarov and Popov (1957) reported from Socotra *P. cognata* Krauss, 1877. However, according to Hsiung and Mc Kevan (1975), while the subspecies *P. conica kurii* Hsiung et Mc Kevan, 1975 occurs on the islet of Abd-el-Kuri (not far from Socotra), on Socotra a species to be assigned to *P. conica tereticornis*, but characterized by a very long head, occurs. Compared with long series of African specimens, those above listed are characterized by a very small size. Its presence on Dacsa Is. was previously unrecorded.

Fam. Acrididae

***Acrotylus incarnatus* Krauss, 1907**

Material examined. Socotra, Di Lisha 4.IV.2008, B.Massa (1♂, 1♀); Hom Hil 5.IV.2008, B.Massa (1♂); Qalansiyah river (Shata) 6.IV.2008, B.Massa (1♂, 2♀); Ra's Shoab 6.IV.2008, B.Massa (2♂, 1♀); Tenten 7.IV.2008, B.Massa (1♂, 1♀); Zam Hom 8.IV.2008, B.Massa (1♂, 2♀); Wadi Ayev 10.IV.2008, B.Massa (1♀), 20.II.2009, P.Lo Cascio & F.Griti (1♂, 1♀); Wadi Da'arho 21.II.2009, P.Lo Cascio & F.Griti (2♂); Detwa Lagoon 26.II.2009, P.Lo Cascio & F.Griti (2♀).

Remarks. Krauss (1907) described *Acrotylus longipes* var. *incarnata* from Socotra for its rose-coloured wings ("*Differt a forma typica alis basi dilute incarnatis*"). Uvarov and Popov (1957) pointed out that all the specimens from Socotra have rose-coloured wings, but do not differ morphologically from the East African *A. longipes* var. *meruensis* Sjöstedt, 1932, in which wings are either rose or yellow. Because of the larger and heavier body of Mediterranean *A. longipes* (Charpentier, 1845), compared to Socotra specimens, they proposed to consider *A. incarnatus* specifically distinct. Thus, *A. longipes* var. *meruensis* should be synonym of *A. incarnatus*, raised to valid species, and consequently distributed on Socotra, as well as on East Africa.

It is well known that *A. longipes* is characterized by its very long mid femora, mainly when they are compared with the width of tegmina. Also the ratio mid/fore femora permits to separate easily *A. longipes* from species with shorter and stout mid femora, such as *A. patruelis* (Herrich-Schäffer, 1838), *A. insubricus* (Scopoli, 1786) and *A. fischeri* Azam, 1901 (ratio in males between 1.3 and 1.5, in females between 1.3 and 1.6). Although I found statistical differences between these species and *A.longipes*/*incarnatus*, I failed to find any significant difference (test t of Student) between *A. incarnatus* and *A. longipes* from Sicily (type locality). Concerning the size of *A. incarnatus* and *A. longipes*, I measured the body length of both species (Table 1). While between males differences did not result significant, between females they were statistically significant (test t of Student, $P<0.01$, f.d.: 38), which means that on average the female of *A. longipes* is smaller than the female of *A. incarnatus*. This is the opposite of what Uvarov and Popov (1957) wrote. However, I measured a series of *A. longipes* var. *meruensis* from Somalia, preserved in the Museo Civico di Storia Naturale of Milan,

labelled as *A. incarnatus* (det. M. La Greca), as well as *A. longipes* var. *meruensis* (det. V.M. Dirsh) (Table 1); differences between the ratio mid/fore femurs of *A. longipes meruensis* from Somalia and *A. incarnatus* from Socotra resulted highly significant for both sexes (test t of Student, P<0.001, f.d.: 28 and 32, respectively), between the body length of males resulted not significant, while between females resulted statistically significant (P = 0.006, f.d.: 32).

TABLE 1. Biometrics (in mm) of *Acrotylus* spp. (mean ± s.d.) Total length between head to apex of hind femurs.

Species and sex	Total length	Ratio mid/fore femurs
Acrotylus incarnatus males (n=10)	17.13 ± 0.67	1.64 ± 0.07
Acrotylus incarnatus females (n=11)	21.25 ± 0.70	21.25 ± 0.70
Acrotylus longipes males (n=30)	16.7 ± 0.68	1.60 ± 0.08
Acrotylus longipes females (n=30)	20.25 ± 0.82	1.67 ± 0.14
Acrotylus meruensis males (n=20)	16.68 ± 1.01	1.45 ± 0.08
Acrotylus meruensis females (n=23)	19.92 ± 1.40	1.53 ± 0.10

According to Ingrisch (1999), the keel in the prozona of the pronotum of *A. longipes* is absent and the principal sulcus is slight sinuate, weak in middle, other sulci are absent in the prozona. As shown in Figs. 8, 11 and 14, the keel in the prozona of *A. longipes* is actually weak, while in *A. incarnatus* it is very weak, almost absent (Figs. 10, 13, 16); further, *A. incarnatus* and *A. longipes* may show a second inappreciable sulcus in the prozona (Figs. 8, 9). Concerning *A. longipes meruensis*, its pronotum, in lateral view, has a different profile from the other two species, and seen from above it shows the presence of a small keel in the prozona; its principle sulcus is strongly sinuate and distinct in middle, similar to that of *A. blondeli* Saussure, 1884 (Ingrisch 1999), differing from the former for other characters. Additionally, as reported above, the former has shorter mid femurs than Socotran *A. incarnatus* and Sicilian *A. longipes*. The ratio between the prozona and metazona of the pronotum is another character which consents to separate at least two of the three species; in *A. incarnatus* the metazona is between 1.6 and 1.8, while in *A. longipes* it is between 1.3 and 1.5 and in *A. meruensis* between 1.7 and 1.9 longer than prozona (Figs. 11-16). The pronotum profile of *A. incarnatus* is more evidently excised on the lateral lobes and more elongated backwards (Figs. 9, 10). Thus, we may consider *A. incarnatus* a distinct species from *A. longipes*, but also from the East African *A. longipes meruensis*, which could be raised to valid species, clearly distinct from them.

Finally, it seems that *A. incarnatus* is present only on Socotra and that in Somalia and possibly in East Africa another species occurs, *A. meruensis*, till now considered as a synonym of *A. incarnatus* (Eades & Otte 2008).

Acrotylus insubricus (Scopoli, 1786)

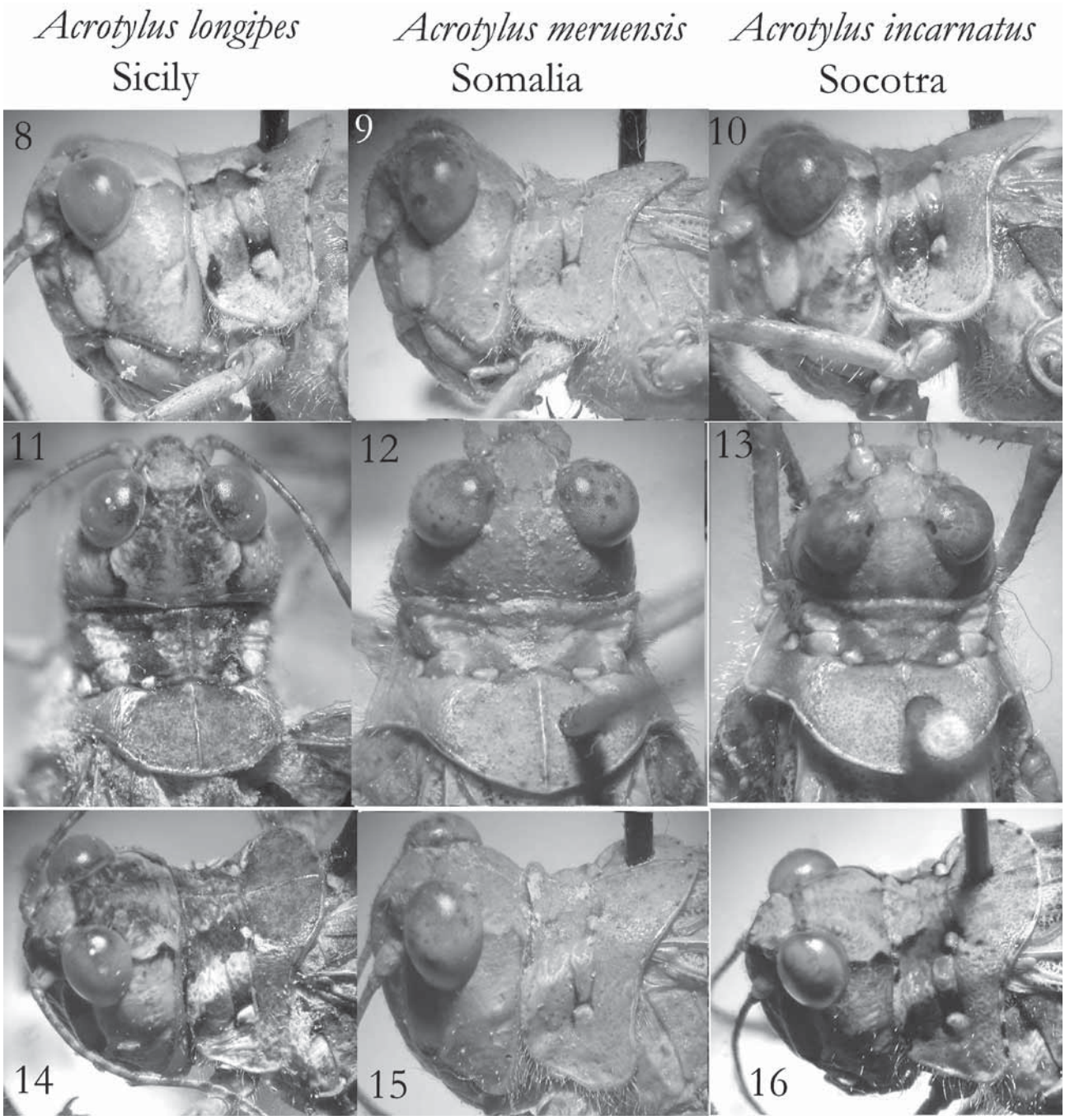
Material examined. Socotra, Hom Hil 5.IV.2008, B.Massa (1♂, 1♀); Wadi Da'arho 21.II.2009, P.Lo Cascio & F.Griti (1♀).

Remarks. Previously unrecorded from Socotra, it is a a widespread species, covering S Europe, SW Asia, Arabia and much of Africa (Ingrisch 1999).

Sphingonotus insularis (Popov, 1957)

Material examined. Socotra, Di Lisha 4.IV.2008, B.Massa (3♂, 3♀); Hom Hil 5.IV.2008, B.Massa (4♂, 3♀); Qalansiyah Mt. 6.IV.2008, B.Massa (1♂); Tenten 7.IV.2008, B.Massa (1♀); Wadi Zerig 8.IV.2008, B.Massa

(1♂); Di Hamri Beach 9.IV.2008, B.Massa (2♂, 2♀); Wadi Ayev 20.II.2009, P.Lo Cascio & F.Griti (1♂); Samah Is. 27.II.2009, P.Lo Cascio & F.Griti (1♂).



FIGURES 8–16. *Acrotylus*. Lateral and view from above of *A. longipes* from Sicily (8, 11, 14), *A. meruensis* from Somalia (9, 12, 15) and *A. incarnatus* from Socotra (10, 13, 16).

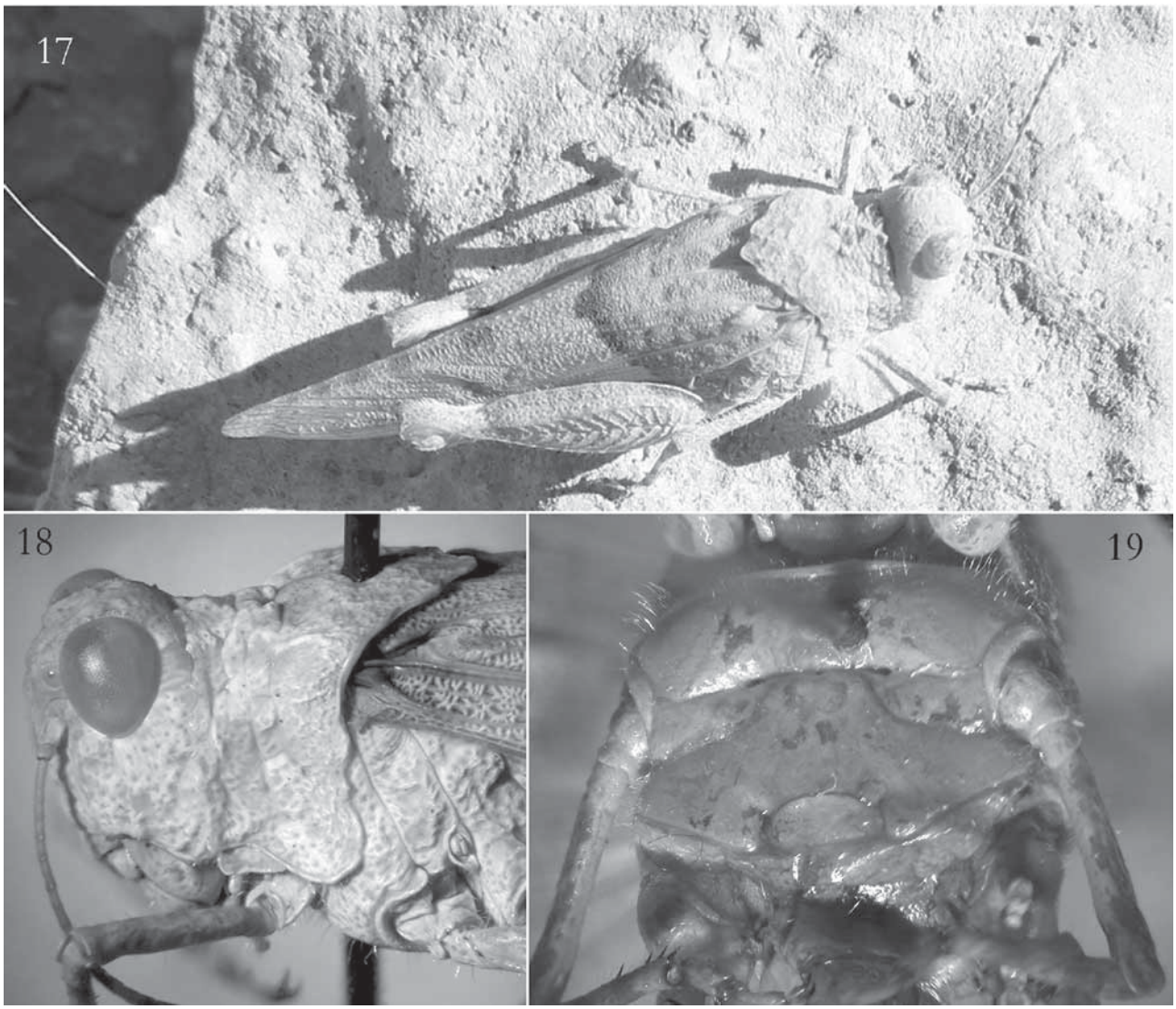
Remarks. This species was described as *Wernerella insularis*, but I provisionally placed it in *Sphingonotus* Fieber, 1852 for the reasons reported below. *Wernerella* Karny, 1907 was erected for *Thalpomena picteti* Krauss, 1892 from Tenerife, and included 10 Canarian and African species, characterized by a rugose pronotum with lateral carinae in the metazona. Hochkirch and Husemann (2008), on genetical and morphological bases, established that the Canarian type species of the genus actually belongs to *Sphingonotus*. However, the Socotran species, as well as some African species (cf. Johnsen 1985), have characteristics well different from other *Sphingonotus* and cannot be classified within this genus. A more

extensive study of African related genera and other species formerly included in *Wernerella* is needed before to establish a new genus for them. Here, I report characters which consent to easily separate it from *Sphingonotus*.

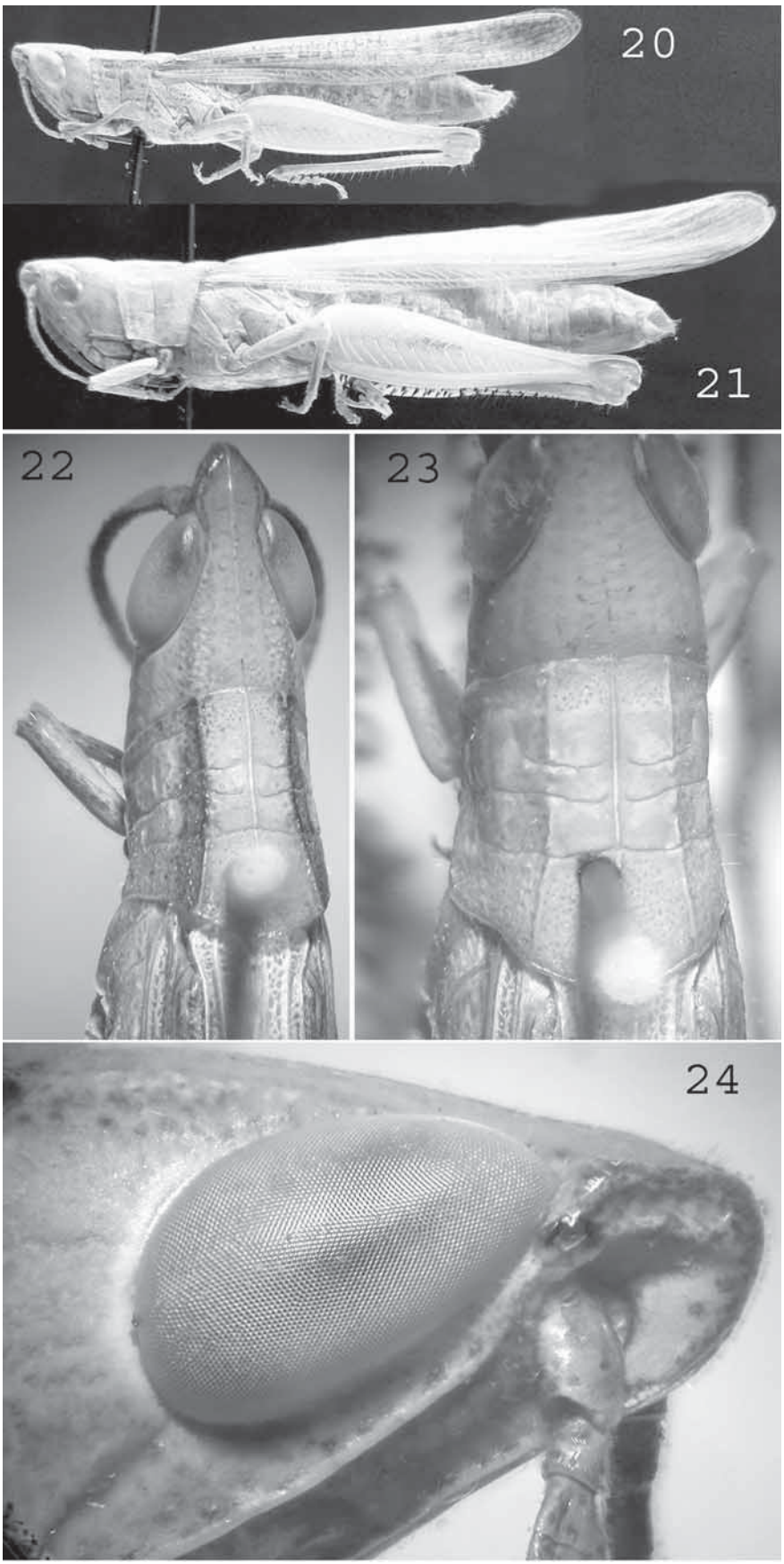
Tegmina are short, wings are large and the general aspect is stout. Mesosternal and metasternal interspaces are very large, ca. 2 times larger than long the former and 3 times the latter (Figs. 17-19). All margins of the pronotum are undulated, the upper carina of hind femora is also undulated and shows a sudden drop in height, proximal to the narrowing part. Upper inner area of hind knees is provided with many setae and the corresponding area of tegmina is covered by microscopic "pearls", as those recorded by Johnsen (1985) for *Wernerella somalica* Johnsen, 1985. I observed that Socotra specimens, as supposed by Johnsen (1985) for *W. somalica*, when start to fly, emit a peculiar song, produced by the pair setae/"pearls".

***Ochrilidia socotrae* n. sp.**

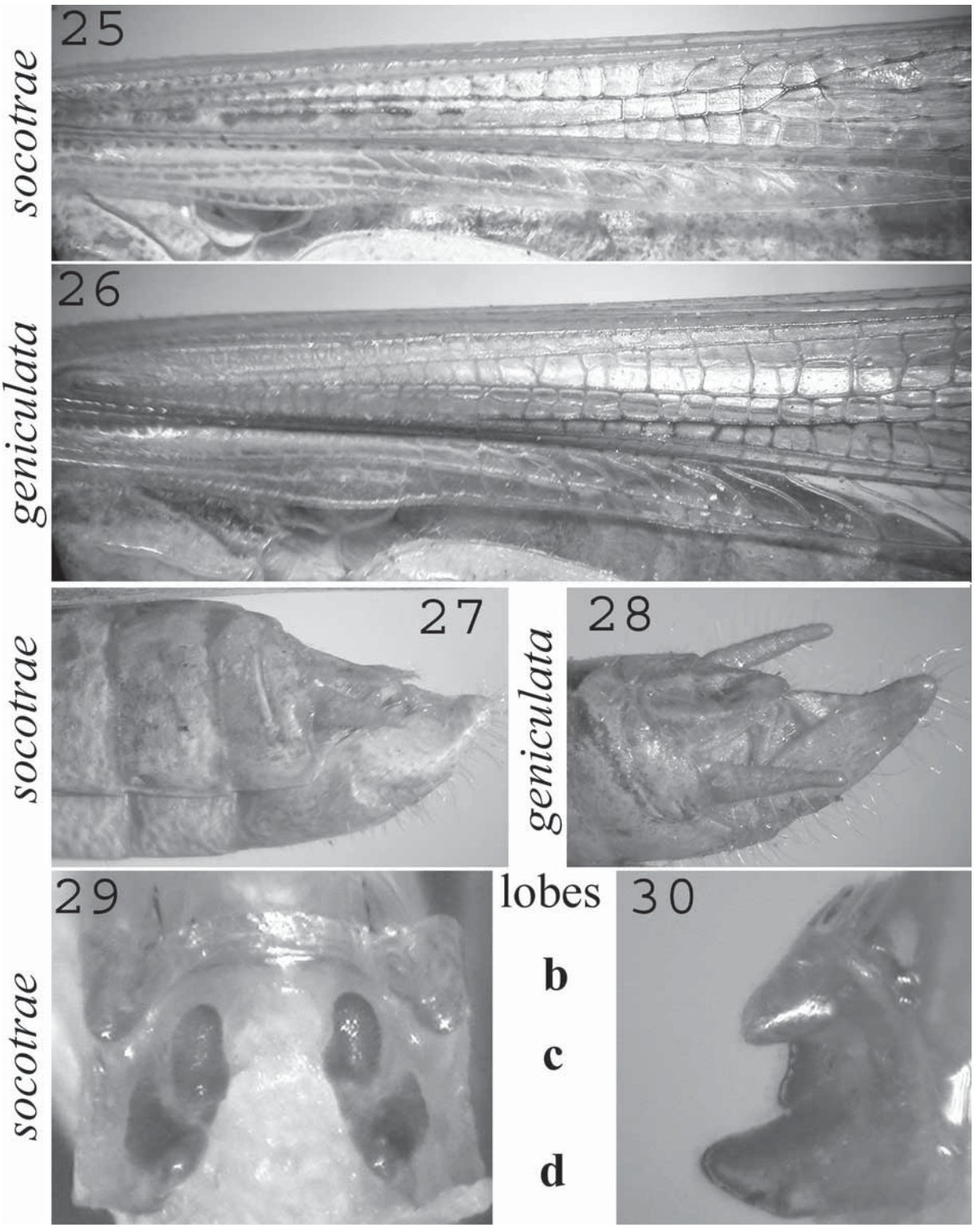
Material examined and types. Socotra, Ra's Shoab 6.IV.2008, B.Massa within bushes of *Heleochloa dura* (11♂, 5♀). ♂ holotypus, ♀ allotypus (Figs. 20, 21) preserved in the Museo Civico di Storia Naturale of Genoa, paratypes in the coll. B.Massa, University of Palermo.



FIGURES 17–19. *Sphingonotus insularis*. 17: female in situ; 18: lateral view of the pronotum; 19: meso- and metasternal space.



FIGURES 20–24. *Ochrilidia socotra* **n.sp.** 20: lateral view of the male; 21: lateral view of the female; 22: head and pronotum of the male from above; 23: pronotum keels of the female; 24: lateral view of the head of the female.



FIGURES 25–30. *Ochrilidia*. 25: tegmina of the male of *O. socotrae* **n.sp.**; 26: tegmina of the male of *O. geniculata*; 27: last sternite and cerci of *O. socotrae* **n.sp.**; 28: last sternite and cerci of *O. geniculata*; 29-30: epiphallus of *O. socotrae* **n.sp.** from above (29) and in lateral view (30).

Previous records. Two species of *Ochrilidia* Stål, 1873 were previously known on Socotra, *O. kraussi* (Bolivar, 1913) (Uvarov & Popov 1957) and *O. gracilis nyuki* (Sjöstedt, 1909) (Jago 1977). Concerning the latter, yet found only on the Hadibou Plain, it is generally associated with vegetation of humid zones; it is

easily recognizable by its elongate vertex, temporal foveolae narrow and not visible from above, knee of hind femurs lacking black spot (Jago 1977). As regards *O. kraussi*, Uvarov and Popov (1957) recorded it from the same locality and on the same plants where I found the specimens above listed on 2008; however, this taxon has been synonymized with *O. geniculata* (Bolivar, 1913) by Jago (1977) and also Mistshenko (1986) agreed with this synonymy. Uvarov and Popov (1957) pointed out that the specimens collected at Ra's Shoab (2 males and 2 females) were smaller and shorter compared with specimens coming from Sahara, and with metazona as broad as long. When Jago (1977) revised *Ochrilidia*, examined the specimens preserved in the British Museum, but he did not list within material examined Socotra specimens quoted by Uvarov and Popov (1957). I was unable to identify Socotra specimens collected by me either following the key of Salfi (1931) or the key of Jago (1977). In the former case I tentatively identified them as *O. rothschildi* (Bolivar, 1913), junior synonym of *O. geniculata* (Bolivar, 1913), in the latter as *O. geniculata*, in a dubitative way. For the reasons below reported, I consider that they belong to one undescribed species, to some extent related to *O. geniculata*.

Description. Lower margin of temporal foveolae is visible from above, foveolae are 4 times longer than high, pronotum keels more or less parallel in the prozona and just diverging in the metazona, pronotum much rugose with impressed points, interocular distance less than 1/2 width of fronto-vertical part of head in front of eyes in males, 1/2 to 3/5 in females (Figs. 22-24); antennae not very long, reaching the mesonotum in males, the hind margin of the pronotum in females. Tegmina exceed apex of the abdomen, showing marginal area narrow and much close to submarginal (Fig. 25). A small black spot is present on the upper side of fore and mid femora. Lower inner lobe of knee of hind femora shows a black spot, covering from 1/4 to 1/3 of the lobe in males, more extended on all the lobe in females. The inner side of male hind femora bears ca. 120-130 stridulatory pegs. Hind tibiae violet. Tegmina exceed the apex of hind femora ca. 2.9-3.2 mm in males and 4.1-4.5 mm in females. Male cerci are just longer than epiproctus, subgenital plate is a little pointed (Fig. 27). Epiphallus (terminology according to Jago 1977) with erect ancorae, in dorsal view upper lophal lobe (*b*) large, median lobe (*c*) long and inclined inwards, and lower lobe (*d*) triangular and well separated from *c* (Fig. 29). In lateral view lobe *c* is just visible between *b* (pointed) and *d* (very much protruded), about twice length of *b* (Fig. 30). Aedeagal valves are directed dorsally and obliquely.

Biometrics and comparison with *O. geniculata*. Socotra specimens resulted very small; I compared them with a long series coming from N Africa and Arabia and I found a very high reduction of the size. Tables 2 reports measurements of *O. socotrae* n. sp. compared with *O. geniculata* (specimens from Algeria, Tunisia, Libya and Arabia). My measurements of *O. geniculata* match those reported by Jago (1977) for gregarious populations. All pairs of data resulted statistically highly significant (test t of Student, $P<0.0001$). Additionally, I compared the ratio total length/length of tegmina (*O. socotrae*: males 1.20 ± 0.07, females 1.21 ± 0.04; *O. geniculata*: males 1.11 ± 0.06, females 1.11 ± 0.05) and the ratio length of tegmina/length of hind femurs (*O. socotrae*: males 1.65 ± 0.07, females 1.63 ± 0.04; *O. geniculata*: males 1.81 ± 0.10, females 1.76 ± 0.09). In both cases, I found statistically highly significant differences (test t of Student, $P<0.0001$ for all pairs, except length of tegmina/length of hind femurs for females, for which $P=0.004$).

O. geniculata shows comparatively longer antennae (in males they arrive between meso- and metanotum, in females to mid legs). Interocular distance is more than 1/2 width of fronto-vertical part of head in front of eyes in males, 3/5 in females. Tegmina are longer with wider marginal and submarginal areas (Fig. 26), male stridulatory pegs are 130-140. The black spot of inner lobe of knee of hind femurs cover ca. half to 3/4 of the lobe in both sexes, rarely is lacking (Jago 1977). Tegmina exceed the apex of hind femurs ca. 4.9-5.5 mm in males and 5.5-9.2 mm in females. Cerci are longer and exceed clearly the epiproct, subgenital plate is clearly pointed (Fig. 28). In the epiphallus of *O. geniculata*, in lateral view the lobe *b* levels with *c*, lower lobe *d* is well developed and ca. twice length of *b*; in dorsal view the lobe *b* is not much developed and *d* is very close to *c* (Jago 1977). Finally, in *O. geniculata* pronotum metazona is about as long as broad, not longer than broad, as reported by Uvarov and Popov (1957) for its synonymy *O. kraussi*; thus, this character does not differ in *O. socotrae*.

Derivation of name: from the isle of Socotra.

Habits. Species of the genus *Ochrilidia* generally are associated with graminaceous plants; *Ochrilidia socotrae* n. sp. lives on *Heleochloa dura* linked to sand dunes of Ra's Shoab, the East cape of Socotra, characterized also by the presence of *Avicennia marina* on the back of dunes. In April 2008 I found an abundant population, constituted only by adults; males stridulated and in a few cases I observed that they were moving closer to a female. When a male was much close to a female, it raised alternatively hind femurs, showing the black spot, which eventually may act as sexual recognition.

TABLE 2. Biometrics (in mm) of *Ochrilidia socotrae* n. sp. compared to that of *O. geniculata* (Bolivar, 1913). Total length between head to apex of hind femurs.

Species and sex	Total length	Length of tegmina	Length of pronotum	Height of pronotum	Length of hind femurs	Height of hind femurs
Ochrilidia socotrae males (n=11)	18.5 ± 0.64	15.5 ± 0.90	2.95 ± 0.14	2.14 ± 0.20	9.36 ± 0.39	1.92 ± 0.09
Ochrilidia geniculata males (n=25)	20.72 ± 1.21	18.64 ± 1.47	3.47 ± 0.26	2.55 ± 0.16	10.31 ± 0.61	2.27 ± 0.10
Ochrilidia socotrae females (n=5)	26.3 ± 0.77	21.8 ± 0.60	4.54 ± 0.15	3.52 ± 0.11	13.4 ± 0.40	2.80 ± 0.07
Ochrilidia geniculata females (n=25)	32.41 ± 1.73	29.23 ± 2.05	5.92 ± 0.38	4.52 ± 0.41	16.6 ± 1.18	3.45 ± 0.27

Acknowledgements

I would like to thank very much Francesco M. Raimondo, manager of the Botanical Garden of Palermo and of the expedition to Socotra, Luigi Guiglia, Ahmed Saeid Suliman, director of the Conservation Unity of the Socotra Archipelago Conservation and Development Programme, who faciltated visit and collecting on the island. I am indebted to Attilio Carapezza, who collected together me insects at Socotra, and Pietro Lo Cascio and Flavia Griti who sent me some specimens collected in the Socotra archipelago between 20th and 27th February 2009. I also thank very much Hendrik Devriese (IRSNB, Department Entomology, Bruxelles), who identified *Paratettix subpustulatus* and sent me interesting considerations. I also thank Maurizio Pavesi and Michele Zilioli for facilities and assistance during the study of specimens of La Greca's collection preserved at the Museo Civico di Storia Naturale of Milan.

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